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REMARKS ON NEPHROLITHIASIS [1]

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IT is difficult to know, when one is asked to open a discussion on nephrolithiasis, how thoroughly he should consider the subject; for it is so vast that an entire evening would not suffice to cover it in a painstaking way, and yet omissions of important parts would leave it open for many criticisms in the open discussion to follow. On the other hand, if the surgeon opening the discussion were to take up only certain points which are to-day not well understood by the profession, and were to emphasize the importance of their special consideration, they might not appeal to the gentlemen who were asked to discuss certain parts of the subject, and might therefore not be taken up by them. It appears to me therefore that it would be advisable for anyone who is, in a general way, opening a discussion which is to be followed by special consideration of various parts by others of the Association, to notify each one what he considers to be most important points, that they may be gone into more minutely by the other participants in their remarks.

These ideas, however, have not been carried out by me in the programme of to-day, and therefore my part of the discussion may be of greater length and more of a review of the subject than I would like to have it, as I will take up in a general way the etiology, diagnosis and treatment of the subject.

The *etiology* of nephrolithiasis will not be discussed in detail in this paper, as it involves many an abstruse question in the domain of pathologic metabolism, to encroach upon which lies beyond the intention of the writer. I will, however, consider under this heading the pathological changes caused by renal calculus, that

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we may be better able to grasp the conditions referred to under diagnosis and treatment.

It may be said that there are certain predisposing factors that have been noticed in connection with the occurrence of stone, pre-eminent among which is that of *age;* for it has been conclusively proved that this disease is most often met with in persons in the middle of life's highway—that is, between the ages of twenty and fifty years. Women are more frequently affected than men.

Country and race have some influence upon the development of stone, as warm countries seem to favor it. For example, renal calculi are very common in India. Renal stones are generally stated to be more frequent among the Anglo-Saxons than among the Latin races, especially the Spanish and Spanish-Americans. I think, however, that such conclusions are due to the fact that better statistics and more complete reports on this subject have been published in Anglo-Saxon literature than elsewhere. Personally, I have found stone more common in this country among Italians than in any other race.

There are *two varieties* of stone, *primary and secondary.* The primary stones are formed by the precipitation of substances formed in the kidney without any previous pathological changes in the parenchyma, the stroma, the pelvis or the calcyces.

The secondary stones are the result of pathological processes in these localities and are formed when certain salts are precipitated, owing to the decomposition of the urine. Of course, a calculus may be originally primary, and by its presence so irritate the surrounding tissues that lesions develop which give rise to secondary calculous deposits over the primary calculus.

Of the *primary variety* of calculi we have those formed in acid urine and those formed in alkaline urine. The varieties developing in acid urine, consist of one or more of the following substances: uric acid, urates, calcium oxalate, cystin and xanthin. Those formed from alkaline urine consist of calcium carbonate, acid phosphates of calcium, or basic phosphate of calcium.

Secondary calculi are precipitated from alkaline urine rendered so by ammoniacal decomposition, due to some local infection or inflammation. They consist of phosphate of ammonium, phosphate of magnesium, or of phosphate of ammonium and magnesium.

Calculi vary greatly in *number* from one to over two hundred, and in size from grains of sand to masses weighing five pounds. The usual *weight* of a calculus is from half an ounce to two ounces.

Stones are more often found in the right kidney than in the left, while the frequency of stones occurring in both kidneys is variously estimated at from five to fifty per cent.

The *effects of renal calculi* must be considered in connection with the causes and pathology, as a knowledge of the secondary changes in the kidney, the pelvis and the ureter, as well as in other parts affected by renal stones is of importance to the surgeon. The effects of primary calculi may be conveniently grouped under two headings, following the classification of Albarran, Morris, and other writers on the subject, as the aseptic changes, and the secondary or septic changes.

The aseptic changes of primary calculi begin with a secondary nephritis of calculous origin (nephrite diathesique of Albarran). This is nephritic inflammation, beginning in the renal epithelium, later involving the interstitial framework of the organ, and, according to Albarran, is always present in calculous kidneys. When the calculi have reached a considerable size and have remained in the kidneys for a long time, especially if they cause obstruction of the ureter, other lesions may become associated with this nephritis. The first of these is atrophy, which is the result of the interstitial nephritis; in other cases the mechanical obstruction produced by the stone gives rise to a hydronephrosis, and finally sometimes the perirenal fat hypertrophies to such an extent that it forms a large lipomatous tumor within which the atrophied and shrunken kidney is enclosed.

The septic lesions of primary calculi are secondary to the aseptic changes. The source of the sepsis is usually an ascending affection from the urethra and bladder (Tuffier), or the bacteria may reach the kidney through the blood or the lymph. The predisposing factors to septic infection which exist in calculous kidney are the traumatic effects of the stones, the calculous nephritis, the urinary retention which they cause, and the capillary congestion of the organ. The results of infection in calculous kidneys are: pyelonephritis, pyonephrosis and perinephritis.

The pyelonephritis of renal calculi is characterized by a septic diffuse sclerous nephritis, which was described by Albarran.

It has been noted, however, that when the sclerotic processes (which precede the pyelonephritis as results of the secondary aseptic nephritis, of which we have spoken) are sufficiently far advanced, the kidney itself seems better able to resist the invasion of bacteria.

The kidney affected with pyonephrosis as the result of infection and of calculous obstruction of the ureter, usually reaches a considerable size, and often presents a series of loculi filled with purulent material, and containing calculi which are difficult to dislodge from their cavities on account of adhesions. The abscess cavity may burst and the contents burrow in different directions.

The perirenal fatty capsule is often thickened and the seat of the fibrous changes in the presence of renal calculi and infection. If the latter be virulent, there arises a true perinephritis and adhesions may bind the kidney to the surrounding organs—a fact of importance to be remembered when operating in such cases, as in some instances adhesions exist between the kidney and vena cava. The perinephritis may, of course, suppurate; the pus may burrow in various directions, and may empty through fistulous openings.

The opposite kidney is often the seat of compensatory hypertrophy, in order to make up for the loss of renal tissue occasioned by the presence of stones, and for the atrophic changes in the renal parenchyma of the calculous organ. In other cases the opposite kidney may be the seat of secondary nephritis, due to the excessive strain, and to the great amount of uric acid, oxalates, and phosphates and the like (as the case may be), that are eliminated through it; and, finally, it may be the seat of the same forms of calculi as on the opposite side.

Suppression of urine results when the pelvic orifices of the ureters are occluded by stones. One kidney may thus be incapacitated and then the other; or both may be put out of work altogether. If the stones become impacted in the ureter further down on their way to the bladder, they may cause ulceration, ureteritis or periureteritis, with the formation of fibrous tissue occluding the canal; or they may perforate into the retroperitoneal or peritoneal cavities, or into the intestine.

Diagnosis.—Under this heading we will take up the consideration of the subjective and objective symptoms, embracing the

history and the examination, together with the differentiation from other conditions.

In considering the clinical features of nephrolithiasis, we must take into account, first, that although most patients come to us with *symptoms,* there is a considerable proportion of cases in which the presence of stones remains unaccompanied by clinical signs. In such cases the stone either remains in the kidney in such a way that it cannot do damage, or is so small that it passes through the ureter into the bladder and is passed out in the urine, or else remains in the bladder as a nucleus for a vesical calculi. Bruce Clark found that in thirteen out of twenty-four autopsies on persons in whose kidneys calculi were present, there had been no symptoms whatever referable to nephrolithiasis. The fact is, the symptoms are not always in proportion to the extent of the disease, and I have often been surprised to find how few symptoms a patient will have when his kidneys have been nearly destroyed by the morbid process.

A second clinical group of cases is one in which the existence of stone is not suspected, because the train of symptoms does not point to any affection of the kidney, but rather to the trouble in the bladder, the uterus, the ovaries or the testicles. In such cases the symptoms are reflex in their origin, as will be seen from what follows.

In a third group of cases, noted particularly by Morris, there is great mental distress and a febrile movement, but no renal colic occurs.

In the majority of cases there is pain in the lumbar region corresponding to the affected side, or in that side of the abdomen, although there may be a general abdominal pain. This pain often runs down into the groin, or the testes of the affected side. It is of varying degrees of intensity, from a dull ache to the excruciating, sharp, cutting pain of renal colic. It may be continuous, but generally follows exercise or jolting, although cases have been reported when it occurred at night.

It is renal colic, however, which usually causes the patient to consult a physician in cases of stone in the kidney, especially if it be associated with or followed by hematuria. It occurs when a freely movable stone of a certain size begins to engage in the mouth of the ureter, or descend along this canal. The forces

which propel a stone along the ureter in such cases are said to be threefold, viz.; the pressure of pent-up urine behind; the worm-like contraction of the ureter under the irritation produced by a foreign body, and the alternating positive and negative pressure of the act of vomiting which often accompanies the attack of colic.

The clinical picture of a patient in the throes of renal colic is not easily forgotten when once seen. The pallid, anxious face thrown into an expression of the most excruciating suffering, and covered with cold sweat; the characteristic posture of the body with flexed trunk and thighs, restlessly moving from one position to another in the agony of the paroxysm—these are sufficiently typical of renal colic to direct our attention to the probable presence of a stone engaged in the mouth of the ureter or passing down the canal.

The pain in renal colic is the central symptom of the syndrome. Its intensity is said to exceed that of any other pain known to mankind. It is acute, paroxysmal, has its chief seat in the loin or in the side of the abdomen, and radiates along the ureter toward the testicles or the labia majora, or occasionally into the thigh, or even into the opposite side of the abdomen.

A chill frequently precedes the access of pain, and during the attack the patient may faint or have convulsions. Nausea, vomiting and retching often complicate matters during the attack, and painful and frequent passages of urine tinged with blood, or with blood clots, commonly accompany the seizure. The paroxysm usually lasts from two to three hours, and, as a rule, terminates more or less abruptly, the patient feeling relieved and falling asleep from exhaustion.

In some cases the colicky pains are not so violent and represent a milder form of paroxysm, characterized by tenderness over the course of the ureter, and not accompanied by a sharply localized pain, but merely by a diffuse pain over the abdomen.

It is the cases in which the stone remains in the kidney or pelvis without giving rise to attacks of renal colic that present the greatest difficulty in diagnosis. These cases of renal calculus are characterized by the following cardinal symptoms: Pain, referable to the kidney, or some other organ in reflex relation to it, aggravated by motion, by jolts and jars and lessened by rest; hematuria and pyuria.

Reflex pains or referred pains are often met with in nephrolithiasis and frequently mislead the diagnostician. In such cases the renal region may be free from pain. The pain may be seated in the lumbar spines or may be felt in the sciatic nerve or the lumbar sensory nerves, as in lumbar sciatic neuritis. Guyon, who has studied the reflex pains of nephrolithiasis in detail, classifies them as follows: (1) The renorenal reflex. Pain in the opposite, supposedly healthy kidney. Morris, in speaking of renorenal reflex says that the pain in the opposite kidney is of an aching character, not spasmodic or colicky; is transient and occurs as an accompaniment of pain on the affected side. (2) The renovesical reflex, accompanied by pain in the vesical neck, and by frequent and painful micturation. (3) The renoureteral reflex. The pain is felt along the course of the ureter, which is found to be tender on pressure by rectum. (4) The reno-ovarian or renouterine reflex and their analogue, the renotesticular reflex are very misleading and not at all uncommon. (5) The gastrointestinal reflex consists of the phenomenon of *nervous dyspepsia,* accounted for by the connection of the vagus with the renal plexus. In rare cases there are attacks of intestinal colic.

If pain be not the reason why a patient consults a physician for this disease, it may be the presence of blood in the urine. This is one of the most frequent symptoms of renal calculi, and Morris found it to be present in 41 out of 103 operated cases of stone. It must be said, however, that the amount of blood passed is usually scanty, and often only detectable on microscopic examination. It is aggravated by movement and by prolonged standing and lessened by rest in bed, and is due both to congestion and to injury of the tissues by attrition on the part of the stone. Oxalic calculi being rougher than the others, are more apt to cause hematuria.

If the subjective symptoms recounted by the patient sound to us like those of renal calculus, and they concur with the opinions of the different urologists that I have mentioned, the time has come for a physical examination of the patient, and a laboratory examination of his urine.

The best method of palpating a kidney is by placing the tips of the fingers of one hand between the last rib and the external border of the sacro-lumbar muscle and to press upward and inward

while making counter-pressure with the other hand over the front of the abdomen.

In this way we determine the presence of tenderness and mobility, as well as the size of the organ, which are important points inasmuch as an inflamed kidney, especially if it contains a foreign body, is very apt to be enlarged and tender and firmly attached by inflammatory adhesions. A normal kidney cannot, as a rule, be felt, and is not tender to the touch, while a fairly normal calculous kidney, with a small stone present, can often not be outlined.

It is said that palpation will, in certain cases, reveal the presence of stones if they are of sufficient size. This may be true, but I believe it more probable that the enlarged kidney itself is felt, and that stones could not be detected through the hard walls in some cases, or cushions of urine and pus in others.

The phonendoscope, combined with percussion over the kidney, is said to be of value in defining the outline of the organ, but it is not absolutely trustworthy in proving the presence of calculi by the change in the accompanying percussion note.

Examination of the urine.—The examination of the urine of patients with renal stones is a subject of vast importance, which lies beyond the scope of this paper. It is always advisable to have urinary examinations performed by a pathologist or bacteriologist, and not to trust to one's own examination, or to that of an interne, in doubtful cases.

The first thing that may catch the eye of the examiner in the gross examination of the urine is the presence of blood mixed with the urine, and giving it a smoky, brownish appearance, or, frequently, ureter casts, consisting of elongated blood clots.

As a result of pyelitis, which usually occurs in the course of nephrolithiasis and may be slight, the urine contains minute quantities of pus; or the pus may be abundant, the urine having that offensive odor and cloudy precipitate which are characteristic of advanced pyelonephritis.

The reaction is generally acid, except in cases of phosphatic calculi or advanced pyelitis; the specific gravity varies with the amount of diluents taken; the color is usually darker than normal; and, if hematuria be present, blood is found mixed with the urine, giving it a smoky, brownish or porter-like color. The urine often

shows a sediment varying in color from whitish to dark brown or red. The chemical examination usually shows the presence of albumin and of an excess of uric acid and urates, or of phosphates or of oxalates, as the case may be. When pyelitis is present especially, phosphates appear in excess and are deposited in the sediment.

Microscopic examination may show the presence of blood, pus, epithelium from the tubules, the renal pelvis, the ureter or the bladder; casts (hyaline, granular, epithelial, blood, pus or mixed) and bacteria, and often of small concretions of crystals or masses of crystaline sediment, such as those of calcium oxalate, triple phosphates, uric acid and urates, which point to the nature of the stone in the kidney.

When urine of this kind is found in a patient suffering from pains or colic in the region of the kidney, the pains coming usually during the day after exercise, and associated, perhaps, with frequency of urination, one may strongly suspect stone in the kidney on the side where the pain is felt, especially if there are no tubercle bacilli in the urine, or signs of tuberculosis in other organs.

Various diseases of the bladder, such as stone, tubercle, tumor, alone or associated with cystitis; congestion or cystitis due to stricture or prostatic hypertrophy; and cystitis from urethral extension give rise to frequency of urination, hematuria, pyuria, and pain in the abdomen or back. In these cases pyuria and hematuria are purely vesicle, but the epithelia in the urine will be found to be vesical, and there will be no kidney elements present. A urethral and rectal examination, associated with visual exploration of the bladder by means of an examining cystoscope, will usually clear up the diagnosis.

There are cases, however, in which both the kidneys and the bladder are involved, as in the following instances: (1) Stone in the bladder and the kidney, septic cystitis and nephritis. (2) Stone in the kidney with septic nephritis and cystitis from other causes. (3) Stone in the ureter, pyelonephritis; stone in the bladder and cystitis. (4) Stone in the kidney and no symptoms other than a slight aseptic nephritis and bladder congestion from obstruction or other causes.

If our symptoms, physical and urinary examinations point to renal involvement, and our bladder is normal, we must then cathe-

terize the ureters to see if one or both are involved, and to determine by the examination of the individual urines and the injection of methylene blue the degree of inflammation and the comparative functional activity of each organ. In case the bladder is involved, we should try first by active treatment of this viscus to cure the cystitis before ureteral catheterization; but in case the vesical inflammation proves to be obstinate, and we feel that our kidney tissues are suffering more from the delay than from the danger of infection during the manoeuvres of catheterization, we should proceed to the ureteral catheterization after the bladder has been well washed and filled with an antiseptic solution.

It is needless to say that in taking the urine from each kidney, if we can interpret our findings, we will be able to tell the degree of involvement of each organ, if one is diseased and the other healthy, or if both are diseased and the comparative degree of destruction of renal tissue in each. We cannot, however, say that a stone is present, and we must resort to other methods of diagnosis before this can be stated positively.

In case we can catheterize but one ureter, we should collect the urine from that side and leave a soft rubber catheter in the bladder to collect the urine from the other side. If the bladder is aseptic we can then tell the difference in the condition of the respective kidneys accurately; but if the bladder is septic and the other kidney is aseptically inflamed or degenerated it will be difficult to determine accurately its condition.

When one ureter can neither be catheterized nor seen, and the urine coming from the ureteral and bladder catheters are the same, it will be difficult to say whether both kidneys are involved to the same degree, or whether there is some urine leaking down by the side of the ureteral catheter in the ureter of one side, or an absence or obstruction of the ureter and kidney of the other.

As you all know, however, in almost all cases both ureters can be catheterized, and the one secreting more pathological urine has the more diseased kidney on that side.

Having decided that the kidney on one side is involved, alone or to a greater degree than the other, we must make a hasty review of the other renal conditions and submit the patient to some further examinations before submitting him to operative procedures.

Stone in the kidney is more apt to be confounded with tuberculosis or tumor of that organ than with any other renal disease. The principal points of differentiation lie in the history. On the side of calculus there may be the presence of gout, rheumatism, or lithemia in the individual or in the family, while in that of tuberculosis there may be a tuberculous history in the patient or his family. Tuberculosis of the kidney usually comes on more rapidly and the patient is more cachectic; the hematuria and the frequency of urination often take place at night as well as by day, while the pain is not so acute, and neither the pain nor the bleeding is so much influenced by exercise or movements. In renal tuberculosis there may be an involvment of the genitro-urinary tract elsewhere, as in the bladder, prostate, or testes, and tubercle bacilli will sooner or later be found in the urine, or can be determined by guinea-pig or rabbit inoculations.

In cases of tumor of the kidney the malignancy of the growth is expressed by the cachexia and loss of weight which accompany such cases. In such cases the hemorrhages are much more abundant, occur with increasing frequency, and are not necessarily associated with moving or jolting. The organ is usually larger and more clearly outlined as a tumor; the urine may contain characteristic tumor cells, and is not so apt to contain crystals or pus. The pain, not so severe, is always in the back and loins. A varicocele is often associated with it, especially on the left side.

In movable kidney there is a dull ache in this region, or even renal colic; hematuria is always absent or slight; pyuria does not so often develop, and nephritis is not so commonly associated with movable kidney as with calculus. The former condition is generally found on the right side and most frequently in women. It is not so frequently accompanied by enlargement, and when it is, the induration is not so marked, while the kidney may be felt to be movable and easily replaced.

Other conditions likely to be mistaken for stone are a group of neuralgias, which may be either parietal, like sciatica or lumbago, intercostal, or inguinal or else visceral, *i. e.*, renal. The existence of renal neuralgia cannot be denied. It occurs chiefly in neurasthenia, and is also caused by the use of certain irritant drugs, such as cantharides. According to Raynaud and Albarran, a visceral crisis of locomotor ataxia may be seated in the kidney

and manifested by neuralgic pain. It is probable that as our knowledge of abdominal diseases increases it will be found that visceral adhesions and displacements are responsible for many of these neuralgias. Malaria, gout and hysteria have also been accused of causing renal neuralgia. Certain forms of nephritis may also give rise to attacks exactly similar to those of true renal colic, and may be accompanied by hematuria, so that they may be very puzzling. The pain, however, is not aggravated by motion, as in stone. Nephrotomy is here justifiable for the sake of diagnosis and also recommended as a cure of the hemorrhagic or nephralgic nephritis.

A number of other abdominal conditions, such as cholelithiasis, ulcer of the stomach, appendicitis, and the like, have been confounded with renal calculi, the resemblance of the symptoms of which is very interesting, but will be omitted for lack of time.

When we feel reasonably sure that we have renal calculus to deal with, and also that it is on a certain side, from the examination already outlined, it remains for us to prove, as far as possible, that we are right by all the diagnostic means at our command and also to ascertain if there is another kidney present and, if so its condition.

There are, then, but two other methods at our disposal, radiography and an exploratory incision.

If by radiography we succeed in seeing a shadow over one kidney, we can feel reasonably sure that the kidney on that side is involved, even though the pain were in the opposite loin, providing it agrees with the kidney secreting the more pathological urine.

If radiography shows nothing on either side, then an exploratory operation should be done on the side from which the worse urine comes, having obtained urine from both kidneys by ureteral catheterization; or else an exploratory incision down to the kidney on the side corresponding to the ureter that we were not able to catheterize, for the sake of ascertaining the presence of a kidney there and inspecting it. At other times when we are in doubt as to the condition of the two organs, when the incision is made over the diseased kidney the peritoneum can be opened and the hand inserted into the cavity to determine the presence and condition of the other kidney by palpation. I have only

once in fifteen years' experience in urinary surgery opened the peritoneal cavity with the object of determining the presence of the second kidney. This was in a patient who was running a septic temperature, and in whom an enlarged kidney could be felt on one side in whose bladder neither ureter could be seen on account of a hemorrhagic cystitis.

Treatment.—The treatment of nephrolithiasis is operation, and the variety of operation will depend on the condition found, for although we can often picture in our minds in a fairly accurate way prior to our operation the condition that we will find, we can never foretell with a certainty the actual appearance of the kidney.

Operative interference should be divided into four stages:

1. The exploratory incision down to the kidney and its external examination. 2. The exploratory incision into the kidney and its internal exploration. 3. The immediate radical operation. 4. The remote radical operation.

The operations on the kidney in this condition are, pyelotomy, nephrotomy, nephrostomy, and nephrectomy. The varieties of operations on the kidney, especially so far as the incisions are concerned, are too numerous to be considered in other than a general way. They may be divided into two principal classes, the extraperitoneal and transperitoneal. There are three varieties of incisions, vertical, oblique, and transverse, which can be modified or combined to suit the case.

I shall not consider the transperitoneal operation, as it opens the peritoneal cavity and exposes it and its contents to the danger of infection and traumatism.

The extraperitoneal operation, then, is the one of choice, and we will consider this only.

The position of the patient can be either on the face, back or side. If he is lying face downward, the pillow or sandbag should be under the abdomen, and the incision should be vertical along the outer border of the erector spinae muscle from the twelfth rib down. This incision in nephrolithiasis should be only for exploration of the kidney or for a nephrotomy in an aseptic case of stone. In case more room were required, it would be necessary to curve the incision toward the anterior superior spinous process of the ilium.

If the patient is lying on his side, the pillow should be under the healthy side, so as to push up the loin in the region of the diseased kidney and give more room for the incision. The incision may be vertical from the twelfth rib down the outer border of the sacrolumbalis muscle and then curving toward the anterior superior spine of the ilium. This incision gives us far more room than a similar one when the patient is lying on his face, and, in fact, more than any other extraperitoneal incision. Various other cuts are made with the patient on his side, such as the transverse, oblique; straight and oblique with transverse additional incisions, but none is so generally useful as the curved one just described.

The anterior incision is made with the patient on his back and a pillow or block underneath him. It extends along the outer border of the rectus muscle, with perhaps transverse incisions extending out from it laterally, to give more space. It is rarely used.

The consideration of the various incisions having been disposed of, let us take up the question of exploration of the kidney. Having cut down upon it, we remove it from its fatty capsule and free the ureter from the vessels of the pelvis. We note the appearance of the kidney. Indented, irregular, nodular kidneys are very liable to contain stone, and kidneys that are large with pus cavities, or in a state of pyonephrosis, also frequently contain stone. We should then palpate the ureter, and press our finger up into the calyces of the kidney. If no stone can be felt and we feel that one is probably present, we must continue our search. Needling the kidney for stone is advocated by many surgeons, but personally it has never given me any results. If much pus is present, it can be aspirated out, when perhaps stones can be detected through the collapsed walls, especially as the kidney is much diminished in size by this procedure.

If not successful, we must open the kidney, and then the question comes up as to choice of route, whether we should cut through the parenchyma or through the ureteral dilatation into the pelvis. Most surgeons cut through the parenchyma, as they in this way can obtain a better view of the pelvis and the calyces. Others cut into the ureter close to the kidney, insert the finger and palpate with its end the interior of the pelvis and calyces.

Each of these procedures has its advantages and disadvantages. In nephrotomy the interior of the kidney can be more clearly seen and examined, but the hemorrhage is greater, a certain amount of kidney tissue is destroyed by the operation, and the healthy parenchyma is exposed to fresh infection. In the case of pyelotomy we cannot inspect the interior of the pelvis so well, palpation is usually not so satisfactory, and we are more liable to have a urinary fistula; but, on the other hand, we have less hemorrhage, the kidney is not so much damaged or exposed so much to infection.

I think that it may here be said that in a case of calculous pyonephrosis in which there has been a great destruction of parenchyma, we should open through the kidney proper, whereas in more obscure or doubtful cases of calculi either course can be taken.

In case pyelotomy is resorted to through a ureteral incision, the wound can be closed immediately afterward, and a drain inserted down to the closed incision to take care of any urinary leakage that may occur.

In case of nephrotomy in an assumed aseptic case, the same procedure can be resorted to. If, however, any pus is found to be present on microscopical examination of the urine, a tube should be inserted into the pelvis of the kidney for drainage, after which the kidney can be closed up to the tube, or if there is much hemorrhage packing may be inserted about it.

Nephrostomy.—If there is much suppuration and it is difficult to drain the organ after the stone has been removed, it can be brought into the incision and the sides of the renal incision secured to those of the lumbar incision. In this way the drainage can be better controlled, as well as hemorrhage, by being able to pack it more securely.

After nephrotomy or nephrostomy the ureter should always be catheterized from above to see if there is a calculus obstructing the ureter.

Nephrectomy.—If the parenchyma is involved and abscesses are present, or if the kidney is but a sclerosed mass of tissue, or nothing more than a suppurating sac containing stones, then a nephrectomy may be performed instead of a nephrotomy and the organ removed.

There are arguments for and against both these procedures, but the condition of the individual is the main factor to be considered, and the patient's life must never be sacrificed for the sake of performing one operation that is considered more radical than another.

Nephrectomy is a much more dangerous operation than nephrotomy, as there are more adhesions to be broken up, and there is therefore more danger of breaking into the peritoneal cavity, the colon or duodenum. In the first instance, a fatal peritonitis may ensue, while in the other case an intestinal fistula would result. I have cut through the peritoneum accidentally in several cases. Another reason why nephrectomy is more dangerous is because so much extra work is thrown suddenly upon the other kidney, which has perhaps been incapacitated somewhat by the anesthetic.

Treatment of the Pedicle.—The pedicle varies in different kidneys. Sometimes the ureter can be separated with ease from the rest of the pedicle and the ligature passed between the vessels, while at other times they are all three en masse. The ureter can usually be separated, and after clamping the pedicle, a blunt pointed needle, carrying a ligature, can be passed through it and the ligature tied in a double loop on the other side. Later, if necessary, another ligature may be applied over the entire pedicle. Occasionally, the ligature does not hold well, but slips and then there is a bad hemorrhage. In such cases clamps must be immediately put on the pedicle, and the hemorrhage arrested.

In two cases operated upon by me, clamps had to be used and left in situ for four days. In one of these a vessel of the pedicle was transfixed, and in the other the ligature had slipped. The safest material for ligatures is braided silk.

The *prognosis* of operations for renal calculi is always serious, when we remember the risk of anuria and of septic complications, and also the effects of nephrolithiasis upon the parenchyma of the kidneys. The results of operations collected by Morris show that early operation is advisable and that nephrotomy is the operation of choice, giving the smallest mortality. Legueu gave a mortality of 5 per cent. in his series of nephrotomies, and Morris still reduced this figure to 2.9 per cent. A long-standing or permanent fistula occurred in his cases in only

6 per cent. after nephrolithotomy, nephrotomy, and nephrectomy for stone.

Results of Operations.—In a collection of statistics made by Morris from the operations published in America and England between 1883 and 1893 there were: (1) 115 nephrotomies with 103 recoveries and 12 deaths—13.8 per cent.; (2) 32 nephrectomies with 25 recoveries and 7 deaths—21.8 per cent. The results vary greatly according to the presence or absence of septic complications in the kidney.

The *after treatment* of patients who have passed through an operation for stone in the kidney is very important, as upon this may depend the ultimate result of the operation.

The best position for such a patient is on the back and with pillows arranged in such a way that there is no pressure upon the wound. This detail is especially important in cases where drainage is used.

The dressing of such wounds does not differ from ordinary operative wounds of the abdominal cavity. In septic cases drainage should be maintained according to the indications, until the fistula heals. For this purpose, dry gauze wicks placed in the pelvis of the kidney are necessary. In ordinary aseptic nephrotomies the gauze should be inserted down to, but not into, the kidney. A binder is placed over the gauze pad in the loin.

The immediate after-treatment concerns itself with moderating the shock, and does not present any special peculiarities. The danger of shock being over, that of anuria is to be foreseen and prevented as much as possible by all the means at our command. These include the administration of bland fluids; at first hot water, then milk and alkaline mineral waters, saline injections and infusions; hot packs; diuretics; diaphoretics; purgatives, and the use of pilocarpine subcutaneously. Retention of urine should be prevented by passing the catheter as often as necessary, to be sure that the bladder is empty.

The bowels should be moved by salines on the second day after the operation, aided perhaps by enemas of soapsuds. The dressing may be left undisturbed until the third day if the temperature remains normal, and if there is no excessive discharge from the wound. Otherwise it should be renewed sooner or more often according to the amount of discharge and the general con-

dition of the patient. Perirenal suppuration and the formation of pockets of pus may take place, requiring opening and draining until healed.

The duration of the after treatment is usually two weeks, but this period is often prolonged to four or six weeks by suppurative complications. When the wound has finally closed, an abdominal belt or some other means of support should be worn to diminish the danger of hernia, particularly in cases in which an extensive abdominal lumbar incision has been made.

75 West 55th Street.

URETERAL CATHETERISM IN NEPHROLITHIASIS.[1]

By Frederic Bierhoff, M.D., New York.

IN accepting the kind invitation of our Chairman to discuss, or present to you, the value of ureteral catheterism in nephrolithiasis, I did so with the full realization of the fact that the ureter catheter, in cases of this sort, can only be of use in giving us corroborative evidence.

That it is of use in the diagnosis of the presence or absence of stone in the kidney, such authorities as Küster, Wagner, Casper, etc., are agreed. There are certain changes in the urine, in cases of nephrolithiasis which are constantly found, and it is by means of the ureter catheter that we are enabled to locate the side involved.

The gathering of separate specimens for chemical and microscopical analysis and examination is, therefore, the chief function of the ureter catheter in these cases.

Of secondary importance, to my mind, are the manipulations which bring about the passage and the escape of small stones, or gravel, from the kidney or ureter, or the obtaining of scratch marks, on the wax-coated catheter, as proposed by Kelly, or my own pelvic distention test.

It is an admitted fact that the presence of a calculus at any

[1] A discussion on Nephrolithiasis before the American Urological Association, December 6, 1905.

part of the renal pelvis brings about symptoms pointing to a mechanical irritation of the pelvic mucous membrane by the concrement, which are unmistakable when the urine is examined by an expert urinologist. We invariably find blood corpuscles in greater or smaller number, epithelial cells from the renal pelvis, calyces, or upper part of the ureter, pus cells in varying number, and crystals of the urinary salts, or, even crystal conglomerates. At times, when a renal colic is followed by hematuria, the cystoscope will reveal the source of the bleeding to us. Where, however, a macroscopic bleeding is not present, as, for instance, during the periods of rest, the urinary sediment will, almost invariably, when examined under the microscope, reveal the presence of a slight, constant admixture of blood.

It is during the periods of rest that the ureter catheter, when carefully employed, gives us the information necessary to a correct diagnosis of the presence of a stone, and by a comparison of the urines obtained from the two kidneys, reveals to us the involved side.

It is not, however, sufficient to examine the urine obtained by means of the ureter catheter from both kidneys separately for pelvic epithelia, pus, blood cells and crystals, but it is also necessary to obtain the specific gravity of the two urines, for it is usually found that the urine from the affected kidney is of a lower specific gravity than that from the normal kidney, and, in addition, we usually find a trace of albumen in the urine from the affected side.

In addition to the microscopic and chemical examination and comparison of the urines from the two sides, we are enabled, through the employment of the ureter catheter, to locate an obstruction in the ureter; furthermore, to enable gravel or calculus-fragments, or small calculi, caught behind ureteral strictures, or flaps, to escape into the bladder.

By means of the phonendoscope, when combined with the metal cored ureter sound, we may, at times, determine the presence of calculus. By the employmnet of Kelly's wax-coated ureter catheter, we are, at times, also enabled to get valuable corroborative evidence, through finding scratch marks upon the wax-coating.

Just how valuable this method may be, when employed with

other cystoscopes than the Pawlik-Kelly cystoscope, I am not prepared to say.

A further use of the ureter catheter in the determination of the presence or absence of renal calculus, is in the test which was first proposed by me in the issue of the "Medical News," of October 11, 1902, which I termed the "pelvic distention" test. The test is employed as follows:

A catheter is inserted into the ureter of the suspected side, and passed up the ureter until its eye lies within the pelvic orifice. (It is necessary to employ as large a catheter as will comfortably enter the ureteral orifice.) After having assured ourselves, through the nature of the flow of urine, that the eye of the catheter lies within the renal pelvis, we begin to distend the pelvis by injecting sterilized boric acid solution gently, up to such a point that the patient complains of pain in the renal region. This quantity usually amounts to about 30 c.c. The fluid is now allowed to flow off, and the manoeuvre is repeated, until, in all, 250 to 300 c.c. have been employed. In the presence of a calculus, the manoeuvre is followed, within twenty-four hours, by a distinct hematuria, at times so pronounced as to be clearly visible to the naked eye.

The urine should not, however, be examined for the presence of blood until twelve to twenty-four hours have elapsed, so that the mild bleeding resulting from the unavoidable, slight traumatism by the catheter, shall have had a chance to cease. Blood found in the urine after this test, has invariably revealed to me the presence of a renal calculus, even where the X-ray had given a negative result in the hands of experts, and in no case in which a negative result was obtained by means of the pelvic distention test, did either the X-ray or an operation reveal the presence of a stone.

In all, the test has been employed by me, up to the present, in seven cases. In the first, a distinct hemorrhage occurred, so pronounced as to be macroscopic. The X-ray showed the presence of a stone. Operation confirmed the diagnosis.

In the second instance, the pelvic distention test showed the presence of stone. The X-ray showed shadows, so light and indistinct that the X-ray operator declined to make a positive diagnosis of renal calculus. Operation confirmed the findings of the distention test.

In the third case, repeated applications of the pelvic distention test were followed by no bleeding, and the radiograph was negative.

In the fourth case, the pelvic distention test resulted negatively, the X-ray resulted negatively, and the hematuria from which the patient suffered was later discovered to be due solely to a vesical ulcer.

In the fifth case, the test was employed on a patient reported as case No. 1, some time after the stone had been removed from the kidney. The pelvic distention test resulted negatively. Subsequent operation showed the kidney and pelvis to be free of calculi. In this case, the X-ray was not employed, but reliance was placed upon the pelvic distention test.

In the sixth case, the test gave a positive result. The X-ray examination was purposely omitted. The patient was operated upon by Dr. Holdt—who had kindly referred her to me—and a calculus removed from the involved kidney.

In the seventh case, the test resulted positively. Three subsequent X-ray examinations, made by an expert, resulted negatively. The operation revealed the presence of calculi.

I believe that the hematuria which results from the pelvic distention test in such cases as are due to the presence of a calculus, is due to the dislodgment and movement of the calculus by the stream of fluid, and that, as a result of this dislodgment, slight traumatisms of the pelvic membrane are caused by the stone, with subsequent bleeding. In such cases as do not present a stone, the fluid simply acts in the manner that the ordinary pelvic lavage does.

The final, and possibly, most infrequent use of the ureter catheter, in cases of nephrolithiasis, is to bring about the dislodgment of a calculus, which, by obstructing the renal outlet, brings about a condition of calculous anuria.

It will be seen, from my few remarks, that, although the use of the urether catheter has ample justification in the attempt to diagnose and locate a calculus in the kidney or ureter, it is to be employed as only one of the means necessary to the making of an absolute diagnosis, and that the information which it gives us is, in the main, corroborative.

MICROSCOPIC URINALYSIS IN NEPHROLITHIASIS

By Louis Heitzmann, M.D., New York.

THE clinicians have told us that there is not a single clinical symptom which is absolutely positive of the presence of a calculus in the kidney substance or pelvis of the kidney; even the X-ray is not to be relied upon. The next question is whether microscopic urinalysis will reveal the existence of a stone. The answer is yes, but unfortunately not a hearty yes. It cannot be relied upon in every case since, although we can suspect a calculus, we cannot positively tell its presence every time.

As is well known, the most common variety of stone is uric acid, and next in frequency calcium oxalate; both may occur alone or in combination with each other or the urates. Phosphatic stones are much less frequent in the kidney than in the bladder. The gross aspect of the urinary sediment does not always help us in forming an opinion as to the variety of salts it contains, and although the microscope will invariably reveal the presence of an excess of salts, the diagnosis of a stone cannot be made from the mere appearance of even enormous amounts of salts. Cloudy precipitation and offensive odor are not diagnostic of any lesion or any form of calculus.

Uric acid, the presence of which is frequently, but not always revealed by the appearance of a brick dust sediment, is found in so many different varieties under the microscope, that a certain form seems to always be indicative of a stone. This peculiar form is not the frequently seen lozenge crystal, but a rosette formation consisting of needles radiating from the centre toward the periphery. These are sometimes small, at other times large, and are usually associated in the same case with variously-sized spicules, needles and even stellate masses, together with irregular plates. When these different formations are found, we can diagnose the presence of a uric acid stone. As regards calcium oxalate, we have a fairly characteristic picture. When we find irregular amorphous masses of peculiar refraction,

together with the octahedral formations, we can suspect calcium oxalate concretions; with these, round or oval concentrically striated crystals of a high refraction are not infrequently found when mulberry or hempseed calculi of calcium oxalate exist.

When the diagnosis of a stone is once made, its location is easy, as the different epithelia seen in urine can be readily diagnosed. Although even yet not generally admitted, anyone who takes care to thoroughly examine a urinary sediment under the microscope with a proper magnifying power, that is, about 400 diameters, can satisfy himself of the different forms of epithelia, and cannot fail to find that the epithelia in the different parts of the genitro urinary tract are more or less characteristic. In every case there may be some epithelia which we cannot locate positively, but the majority of them are characteristic enough, and will help us to locate the lesion.

The epithelia from the different portions of the genito-urinary tract vary both in shape and size; the shapes, however, alone are not sufficiently distinctive for a diagnosis, but the sizes are different in the various organs. Epithelia from the uriniferous tubules are the smallest found in urine. Presence or absence of casts is not diagnostic for the presence or absence of a nephritis, and a large number of cases of nephritis never, at any time, show true tubular casts in the urine. In the majority of cases of nephritis, pyelitis or pyelo-nephritis, due to a calculus, true casts are not found. On the other hand, casts are frequently diagnosed as present in the urine of persons in perfect health, in whom no other evidences whatever of an inflammation of the kidney are seen.

Suppurative nephritis, pyelitis and pyo-nephrosis are not rarely caused by calculi. In these cases, casts may or may not be present, but the characteristic from the uriniferous tubules, partly cuboidal and partly columnar are constantly seen, together with evidences of destruction of tissue. The diagnosis of a suppurative process of any kind cannot be made without the evidence of destruction as shown by the appearance of connective tissue shreds in the urine, which vary in size, but are perfectly characteristic and can readily be distinguished from mucous threads. The latter are seen in every normal urine, but are increased in pathological processes.

Inflammation, suppuration and even ulceration of the ureter, not rarely caused by concretions or stones can also readily be diagnosed. The epithelia from the ureter are distinctly larger than those from the uriniferous tubules. Epithelia from the pelvis of the kidney are partly round or oval, partly irregular, kidney, bean, or pear-shaped, and larger than those from the ureter, so that the location of the calculus will offer no difficulties whatever.

GYNECOLOGICAL CONDITIONS SIMULATING NEPHROLITHIASIS

By Augustin H. Goelet, M.D., New York

IN presenting that part of the subject assigned me, I find myself confronted with the question: What constitutes gynecological conditions. At the present time, it is by no means strictly defined. Do they signify everything pertaining to women or everything the gynecologist chooses to consider his field? It is certainly true that gynecology to-day is no longer what we thought it fifteen or twenty years ago; and the "passing of gynecology" is no longer a prophecy but an established fact. In proof thereof, the gynecologist of to-day is found doing many general surgical operations, in justifiable retaliation, if you choose to consider it so, for the too liberal encroachment upon his field by the general surgeon. I know at least one gynecologist, for years a prominent teacher in that branch, who has extended his field to the prostate. Shall we consider disease of that organ a gynecological condition?

Let me say in defense of the gynecologist if he needs any defense that his field should not be too much restricted. Its strict limitation would confine him to conditions involving the vagina, uterus, tubes and ovaries, as they are the only organs possessed by woman and not by man. But if he is permitted to include the bladder because it is situated in the pelvis, and because of its intimate relation to the other pelvic organs, he should also be permitted to include the ureters and kidneys, because they are very important parts of the genito-urinary apparatus. Since

abdominal tumors of all kinds almost always have an important bearing upon the pelvic organs, they should also be included in his field. Thus the spleen, pancreas and liver are his legitimate field also. Shall I stop here? If permitted to continue, I will say his field is what he is properly prepared for and what he chooses to make it.

If I had selected the title of this part of the subject, I would have made it "Gynecological Conditions that Nephrolithiasis Simulates," for nephrolithiasis more frequently produces symptoms simulating gynecological conditions than the reverse. Very naturally, therefore, errors in the diagnosis of these cases will be made more frequently by the gynecologist, for they would go first to him. But these two branches, gynecology and genito-urinary surgery, are so closely allied and related that they should go together. In view of this, I would suggest that since gynecology no longer exists as a distinct specialty, the gynecologist should be a genito-urinary specialist, and genito-urinary specialists may be designated genito-urinary surgeons, male or female as preferred.

To judge from my own experience on the operating table, nephrolithiasis is rare in women, for in 209 nephropexies, I have never found stone in either the kidney, pelvis or upper ureter, and I make it a rule to examine carefully every case operated on. These 209 nephropexies were done on 161 patients, in 48 both kidneys being anchored at the same time. Furthermore, I have never been called upon to operate for stone in either the kidney or ureter in woman, though I have removed them from the bladder a number of times. Nephrolithiasis is certainly less frequent in women than in men. One author states, but without giving his authority, that the relative frequency in males and females is 20 to 1.

Tuffier states that in a collection of 203 operations for renal calculus, 94 were men and 109 women. In the same number of operations (203) collected by Henry Morris in ten years, between 1883 and 1893, there were 124 males and 76 females. Adding these two series of operations together, in a total of 406, there were 218 males operated for stone in the kidney and 185 females. Therefore the disproportion does not appear to be so great, but this is only a record of cases operated on.

Undoubtedly nephrolithiasis often escapes recognition in women, which is a possible explanation of the apparent infrequency. In view of the symptoms it produces in common with female pelvic diseases, or rather the symptoms it produces that are directly referable to the pelvic organs which may be coincidently diseased, this is surprising. But it is difficult to believe that the careful diagnostitian of gynecological conditions will commit such an error, for he should not limit his examination to one set of organs. In any event, the kidneys should always be included in his examination, which should never be considered complete without careful microscopic examination of the urine.

If symptoms alone are depended upon for the diagnosis, then errors must frequently occur. Pain and bladder irritation are the two symptoms that most frequently cause confusion. Pain in the loin or back is so often encountered in women with pelvic disease that it may lead to the assumption of such disease without attention being directed to the kidney as a possible cause. This is often observed in women with prolapse of the kidney, many of whom I find have been treated for months for uterine or ovarine trouble without benefit, the displaced kidney being the cause of the symptoms as shown by subsequent operation. The character and seat of the pain produced by nephrolithiasis resembles in many respects that produced by pelvic disorders. It is dull, aching or dragging, often extending down into the pelvis and radiating down the thighs. The pain may even be most pronounced in the region of the ovary and the ovarian region may be sensitive to pressure. Digital exploration through the vagina may reveal extreme tenderness with also some enlargement of the ovary, which is not uncommon in both nphrolithiasis and prolapse of the kidney, as I have pointed out elsewhere. The pain is sometimes referred also to the uterus and to the labia and the urethral orifice. Like the pain caused by disorders of the pelvic organs, that produced by nephrolithiasis is brought on or aggravated by exercising or by prolonged standing and is relieved by rest in the recumbent position.

Bladder irritation so often encountered in pelvic disorders, is likewise a misleading symptom, because it is also produced by stone in the kidney. Patients have been submitted to cystoscopic examination, and have even been treated for cystitis, and the error

has not been detected until someone has diagnosed stone in the kidney, removed it, and thus cured the supposed cystitis. There is, however, a marked difference between the bladder irritation produced by irritation in the kidney and that caused by pelvic conditions. In the former, the bladder irritation is more pronounced during the day, when the patient is exercising, and subsides at night or while the patient is quiet or reclining, whereas when it is due to uterine disorders such as a misplaced uterus or the pressure of a tumor, it is almost always more pronounced during the night, a common complaint of these patients being that they are obliged to get up frequently during the night to void urine. This would not, however, be a rule if there were no exceptions.

Thus it will be seen that any or all diseased conditions involving the pelvic organs may simulate nephrolithiasis and if the symptoms alone are considered, there is a chance of error for both the genito-urinary surgeon and the gynecologist. Nephrolithiasis not infrequently produces no symptoms referable to the kidney, and all the symptoms may indicate, strikingly, disease of some one of the pelvic organs: bladder, uterus, tubes, or ovaries, and unless one is versed in gynecological diagnosis by vaginal palpation, an error might readily occur, more especially since it is rare to find all the pelvic organs in women free from disease. Then too these organs may be involved independently, and at the same time there may be stone in the kidney.

It is reported by Henry Morris that a vesico-vaginal fistula was maintained in a patient for ten years because the symptoms pointed to the bladder only and there were none directing attention to the kidney. The patient was finally cured by removal of a renal calculus and the fistula being closed, there was no return of the bladder symptoms.

Another case is reported where both ovaries were removed without result, but a cure was subsequently effected by removal of a stone from the kidney. I have reported a similar case. A patient for whom I had advised double nephropexy had both ovaries removed by another surgeon, who either did not discover the displaced kidneys or ignored them. No relief followed. Two years later I anchored both kidneys, which effected a cure, all the symptoms being permanently relieved.

Henry Morris also reports the case of a patient who had been treated for eight years for displacement of the uterus. Her symptoms disappeared completely after he operated on the kidney, in which he found two small abscesses in which were calculous masses.

It is recorded that ovarian tumors have been mistaken for a kidney enlarged by the pressure of stone and the error was discovered only at the time of operation. It is difficult to comprehend how a careful diagnostitian can make such an error, for an ovarian cyst springs from the pelvis, and its attachment there should be detected, while the calculous kidney springs from above and is attached there. The difference in the consistence of the two masses should be quite apparent. The calculous kidney when much enlarged forms a hard, immovable, solid tumor. The ovarian cyst, being filled with fluid, is softer, more yielding and movable. The history of the case should throw additional light on the subject, which, with the above, should decide the character of the tumor.

It is quite possible also that the nausea and vomiting sometimes induced by the irritation of stone in the kidney may be mistaken for symptoms of pregnancy, more especially as pain in the back and loin as well as pain in the pelvis is frequently complained of by women when pregnant. But the question of pregnancy can readily be disposed of in the negative or affirmative by one accustomed to the diagnosis of this condition.

It has seemed to me sufficient to mention the chances of error in the diagnosis of the two conditions under consideration without giving the points in differential diagnosis which would be quite unnecessary for this audience and the time allowed would not permit it.

NEPHRO-LITHOTOMY FROM THE STANDPOINT OF THE PROVINCIAL SURGEON.

By Oliver C. Smith, M.D., Hartford, Conn.

Mr. President and Members of the American Urological Association:

Knowing as you do the genial nature of our respected president, you will not be surprised at his having invited a provincial surgeon with limited experience to take part in this discussion.

To you genito-urinary surgeons of the metropolis who are operating upon kidneys daily, a discussion of the technique by one who has operated but infrequently, could be of little interest. I might quote the stereotyped remark of a certain member of our local society. After he has listened to a learned discussion from some man of national reputation, our brother usually rises with the remark: "I fear, Mr. President, I can add but little to the paper," and he is usually taken seriously, for no one has imagined for a moment that he could. Being familiar with the extreme good nature of our president, I propose to take the latitude of digressing from the branch of the subject which has been assigned me, and speak for a moment upon what seems to me the most important factor in renal surgery as it is practiced by those outside of the large medical centers.

A working diagnosis in surgical diseases of the kidney, and especially in nephrolithiasis, presents more complications and difficulties, requires more skill, time, patience and elaborate technique and paraphernalia than almost any other field.

The provincial surgeon reads with enthusiasm the reports of the metropolitan surgeon who has performed large numbers of nephrotomies, nephrectomies and nephropexies, and feels it encumbent upon him to include major renal surgery in his repertoire. He has a patient with hematuria and pyuria with renal pain, and after a cursory examination, concludes that an operation is in order. Others are operating upon such cases—why not he? He has viewed the subject from before the footlights, through the glamor and dazzle surrounding a successful surgical pro-

cedure, but he has not gone behind the scenes and witnessed the tedious work which should precede all renal surgery, except that performed in imperative emergencies. He has not considered the great importance of accurate urinary separation and the scientific, chemical and microscopical examination of the secretion from each kidney. He has not learned by bitter experience that the clinical signs and symptoms may mislead one into operating upon the better of the two kidneys. He has not kept in touch with the efforts of segregation; with the work of Tuchmann, Silberman, Wier, Fenwick, Neumann, Guyon, Cathelin, Harris and Luys. He has not witnessed the painstaking and timetaking efforts in this direction, nor experienced now and then the delights of success, but too often the chagrin of failure. He has heard of the cystoscope, and if progressive has purchased an outfit from a concern at Rochester, and has distended the bladder with air and tried in vain to discover the ureteral openings, but more than likely he is unfamiliar with cystoscopy. He has not followed the efforts of Simon and Pawlik, of Kelly and Rose, of Morris and Nitze, of Brenner and Casper, or of Otis and Brown. If he has worked out this problem and has mastered the cystoscope and ureteral catheter, all of which is out of reach of the men who are not confining themselves closely to this specialty, he will have been dismayed by the constant fire of criticism and warning from the pessimist in this direction, who maintains that the ureteral catheter is accountable for no end of damage by transmission of infection to the ureters and kidney. If he has succeeded in successfully separating the urines, he must now be an expert urinologist and microscopist. If he is looking for evidence of renal calculi, he must be drilled in the detection of renal cells and calculus crystals. If he is looking for tubercle bacilli, he must be willing to examine specimen after specimen, and failing to find the organism, must centrifugalize his specimen and inoculate a guinea-pig. Nor is this all. He must be a student of the work of Koranyi, Koeffe, Lindemann, Kümmell, Ogston, Backman and of Fridenthal, who have brought practical cryoscopy up to its present state of perfection. If fortunate and progressive, he may possess an X-ray machine. He flatters himself that he is doing good work with his flouroscope. He dreams of successfully skiographing renal calculi, and then comes the rude awakening. His plates contain

nothing that is intelligible. He finds shadows which might be taken for stones, occurring where they should not be, and a misty cloud of nothingness where he had hoped to discover the calculus, and then if he will study Dr. Lewis Gregory Cole's latest articles, he will find that instead of his mica plate machine, he must have a twelve-inch coil and a Wehnelt interrupter with a heavy platinum point, and the tube a heavy anode 8″ bulb made by Gunlach. He must learn of the fallacies which may decoy and deceive him, such as fecal concretions, defects in the plate, calcified appendicae epiplociae, calcareous nodules, tuberculous deposits, vein stones, sesamoid bones and suspender buckles.

He must be a surgical pathologist of no mean attainments, for few conditions in surgery will tax a man's judgment more keenly than the surgical diseases of the kidney. He has succeeded at operation in bringing the kidney into the field. He has stripped the capsule, has used his exploring needle, has incised the pelvis—he may have found several stones, or one, or none at all. He may find calcareous deposits, hemorrhagic infarcts, septic thrombi, tubercular deposits, or a neoplasm, and the crucial question comes to him with awful earnestness—shall he lay this kidney open from the convex border to the pelvis? shall he remove the stones and drain the foci? shall he open the peritoneal cavity and determine with the exploring hand if a second kidney exists, and if so what is its condition? or shall he remove the kidney?

If he is a man of delicate conscience, the conviction will come over him with tremendous force, that he should not have engaged in this serious and complicated business until he had mastered its rudiments and served at the feet of the masters.

Two years ago, before our Connecticut State Society, I earnestly advocated that one or two physicians in each city and town, acquire the necessary skill and knowledge and equipment to conduct these various diagnostic procedures, and urged upon the general profession to support men who would devote themselves to this scientific line of work.

The surgeon must learn to be liberal to the man who devotes his time and energies to this all important preliminary field. Because such is not always the case, it is difficult to convince young men that such work is to their advantage. Their goal is the operating table and the emoluments that are supposed to accom-

pany it. The drudgery of the laboratory, of the cystoscope, the ureteral catheter, the X-ray and the cryoscope offer few inducements, and are rarely carried out in the smaller communities.

You of the large medical centers must be aware of the powerful influence you wield over the men of lesser opportunities, and you will perhaps pardon me for suggesting the importance in your writings and your addresses of emphasizing the necessity of careful, skillful and scientific work in establishing as nearly as possible, a correct diagnosis in these kidney lesions, rather than devoting more time to the elaboration of the operative technique and recital of alluring statistics.

THE MORTALITY IN OPERATIONS FOR RENAL CALCULUS.

By Hugh Cabot, M.D., Boston.

I HAVE accepted the invitation of your President to be here this evening and discuss some aspects of the mortality attending operations for stone in the kidney, because I feel that much may be done, particularly by an association of this kind, to improve existing conditions.

In dealing with the mortality of operations for stone in the kidney, we may consider it from two points of view. We may deal either with the death rate occurring in the hands of a few selected operators, whose skill, experience in selecting their cases, and reputation enables them to do their work under the most favorable circumstances, or we may consider the proportion of cases which die as the result of operation, taking into consideration all the cases operated upon, whether under favorable or unfavorable conditions. It is this double point of view which has given statistics their rather unsavory reputation, but it seems to me that we are telling but half the truth if we consider only what we may call the necessary mortality. It would be difficult to estimate what proportion of the cases operated upon are in the hands of those thoroughly familiar with the subject, but it will not be denied that a very large number of cases are operated upon by specialists in other lines of work, by the general surgeon, and even by the

general practitioner, and we shall really get a more correct idea of the present condition of the surgery of the kidney if we consider what results *are* obtained rather than what results may be obtained.

I was interested a year ago in collecting the cases recently operated upon at one of the large Boston hospitals, where they came under the care of a number of surgeons, all of them general surgeons, and all of them men of recognized ability. The skill here shown is probably equal to the average skill shown throughout the country, and the mortality is probably about the average mortality. It is, therefore, interesting to compare these results with those of the more special operators.

Mr. Morris collected 243 cases of nephrolithotomy and nephrotomy by special operators, showing a mortality of 7.8 per cent.; 34 cases of nephrolithotomy of his own showed a mortality of 2.9 per cent.; and he expressed the opinion that the necessary mortality ought not to exceed 3 per cent. The mortality of the 33 cases in my collection was 6, or 18 per cent., six times that of Mr. Morris' cases. A further examination of these 6 fatal cases shows that in one-half of them, death was not directly due to stone in the kidney, but to complications which had resulted from this condition and which might have been prevented by an earlier diagnosis. In two of the cases, death was due to septic absorption from large peri- and para-nephritic abscesses, which in one case had perforated both the diaphragm and the large intestine. In another case it was due to the existence of large "elephant" calculi in both kidneys, a condition which must have existed for years. In short, half of this mortality was due to the fact that the operations were done upon neglected cases and it is to these that attention should be more sharply drawn. The high mortality in these cases cannot be reduced by the operating surgeon and improvement must come in more accurate diagnosis and in the earlier investigation of doubtful symptoms. There is a wide-spread tendency, particularly among general practitioners, to treat symptoms and not diseases—in short, to dodge the responsibility of accurate diagnosis. It is our duty to urge upon all who see these cases early, that the best interests of the patient demand a full and careful investigation, that it is not sufficient to relieve him of his symptoms, but that it is necessary to prove, as far as such proof can be obtained, that he either has or has not a

stone in his kidney. We must impress our medical brethren with the fact that the responsibility cannot be shifted to the future, that the question of the cause of renal pain or of renal symptoms is one which demands an answer, and that the failure to give such an answer is likely to expose the patient to future risks, the extent of which cannot be estimated. It is doubtless true that the specialist can do much, by improving methods of diagnosis, to lower the mortality, but he can do so only with the complete co-operation of the general practitioner and by teaching him to study his cases with such care that, should special methods of diagnosis be necessary, he will either apply them himself or ask the aid of those who are proficient in such delicate manipulations. In a word, the mortality of stone in the kidney is to-day, if we consider all the cases, much higher than is necessary and improvement must come as a result of more accurate observation and study by those into whose hands these patients primarily come.

REMARKS ON RENAL CALCULUS.

By Edgar Garceau, M.D., Boston, Mass.

IN photography of the kidney by means of the X-ray, we have a most valuable aid in the diagnosis of calculus, perhaps the most valuable yet discovered. It should not be forgotten that both tuberculosis and certain tumors of the kidney will give shadows which may be mistaken for stone. This is well illustrated by the following case: The patient was a woman twenty-nine years old, who complained of pain in the left hypochondriac and iliac regions for some months. As she was pregnant at the time, she thought the pain was natural to that condition and paid no attention to it. After the birth of the child, the pain grew worse, she had to urinate frequently, and she was confined to bed more or less. The examination of the separated urines showed a small amount of blood on the left side, together with a few epithelial cells of various sizes. The urine from the right kidney seemed normal, and it flowed in a good stream; the urine from the left side was very scanty. An X-ray photograph was taken and showed that there were several shadows on the plate suggesting

stones. At the operation a very large kidney was found riddled with the typical growth known as hypernephroma. There were no stones, and the shadows had been cast on the plate by the separate islets of cancerous tissue.

In cases of suspected calculus it is well to remember that, besides the kidney stone, there may be another one impacted in the ureter in some part of its course. Such a condition, if not recognized, may be the explanation of failure to relieve after a nephrotomy. It is in these cases that the X-ray may be of extreme value, and it should be the rule to photograph not only the kidney, but the whole course of the ureter as well. A positive double picture was the deciding point for nephrectomy as against nephrotomy in one of my cases.

Among those conditions giving rise to mistakes in diagnosis may be mentioned neuralgias of the lumbar region. If such neuralgias are accompanied by a ureteritis or a pyelitis the diagnosis is well-nigh impossible.

An exceedingly rare condition simulating renal stone is hysteria, giving rise to temporary anuria. Hysterical hematuria has been reported, but the cases are so few that one does not look for this as a symptom of hysteria. Cases, however, of hysterical anuria are not so uncommon as to excuse one from ignorance of the possibility of their being met with. Usually there is vicarious vomiting in hysterical suppression, the vomitus containing urea. With a history of pain in the lumbar region, vomiting and suppression suggest calculus rather than hysteria. A careful and critical study of the case is required before arriving at a diagnosis. Hysteria is suggested by finding other symptoms of hysteria, such as anaesthesias, contractions of muscles, etc. The character of the suppression is fairly typical in hysteria, being of an intermittent type rather than continued as is the case in calculous disease: in the former we may find suppression lasting two or three days, to be followed by a period during which there may be a small amount of urine voided, and then a gradual return to normal conditions, only to be succeeded by another attack of total suppression at the end of a few weeks or months; but in calculous anuria there is usually but one attack, sudden and severe, which goes on to a fatal termination within a week or two unless there is prompt surgical relief.

The methods of separating the urines in cases of calculus merits some attention. The microscopic blood observed in these cases is of extreme value in helping to make a correct diagnosis, and the best method of detecting this blood is the one that should be employed. The old ureteral catheters are not only dangerous as regards possible infection of a sound kidney, but they are valueless in fine diagnosis, because, even in the female, when they can be introduced under the eye, they may give rise to adventitious blood on account of the unavoidable lacerations of the ureteral wall, with the sharp tip of the instrument. The Harris instrument is not much better, because, in spite of the greatest care, we may produce slight lacerations of the bladder wall with the instrument and so give rise to microscopic hemorrhage. The Luys instrument is less open to this objection than the Harris instrument; nevertheless, even in skilled hands, it is possible to cause appreciable hemorrhage with this instrument. With the patient in the dorsal position, with the shoulders raised as advised by Luys himself, the abdominal contents are pressing directly down on the sharp tip of the instrument, and a slight hemorrhage may readily happen. In the female these objections may be overcome by the use of Kelly's cystoscope with the oblique tip. With this instrument, having the patient in the knee-chest position, it is possible to collect the urine as it drops uncontaminated from the mouth of each ureter in turn. In this way we get the urine exactly as it is excreted by the kidney. A point to be observed while collecting this urine, is that on the affected side the urine flows with less freedom than it does on the sound side. This is merely presumptive evidence of diseased conditions and is seen in a great variety of kidney lesions.

The treatment of ureteral stones is sometimes difficult and their extraction is often attended with considerable danger. Time is an element not always sufficiently considered, especially in cases in which the patient has been exhausted by a long period of useless waiting in the hope that the stone will be passed per vias naturales.

The following case illustrates a new method of operating for low stone: Mrs. M. L., thirty-four years old, delivered of a child a few weeks before, had been suffering for a week the most excruciating pains in the vain endeavor to pass a large stone impacted in the lower end of the left ureter. She was in a desperate

condition and a long operation was out of the question. On vaginal examination the stone could be just felt with the tip of the examining finger. Removal by simple incision through the vaginal wall would have been fraught with considerable difficulty on account of the distance of the stone from the vaginal outlet, especially in the event of a hemorrhage, which seemed not unlikely to happen as the patient had just been delivered of a child and the parts were in a congested state. It was thought that if the stone could be pushed down into the vagina and kept there while the vagina was being incised, the stone would serve as a guide upon which to cut. This was tried by pressing down through the abdominal walls, but it was not satisfactory; the stone slipped. The thought then occurred to me to incise the anterior cul-de-sac, push back the peritoneum between the bladder and the uterus as far as the broad ligament, then evert the broad ligament backwards with the tip of the finger, catch the stone behind the broad ligament with the tip of the finger crooked at the last joint, force it downwards towards the vaginal outlet, cut upon it with a very small incision, and finally squeeze it out. Hemorrhage could be easily controlled at any stage of the operation by pressure with the finger. The steps were carried out as planned without the least difficulty. With appropriate retractors, the vagina was exposed and the anterior cul-de-sac was opened, the peritoneum pushed back, and the broad ligament everted. The stone was found with ease and was pushed down towards the vaginal outlet and was delivered through a very small incision. Silver sutures were immediately taken, and healing took place by primary intention, there being no resulting fistula. The ureter remained pervious as demonstrated later by ureteral catheterization.

The stone was delivered in five minutes and the whole operation took only ten minutes.

At the time the operation was performed, I was not aware that Doyen had originated an almost similar operation for the removal of ureteral stones. Doyen, however, in his operation, incises the anterior cul-de-sac, exposes the ureter in the cul-de-sac, and finishes the operation by removing the stone *through* the cul-de-sac, and suturing the ureteral wall. This operation must take a good deal of time on account of the technical difficulties, and a fistula must be more serious in the anterior cul-de-sac than in the

vagina, should one result. The advantages of the operation as performed upon my patient are obvious. The technique is simple. Hemorrhage is under perfect control. It is very rapid. I feel certain that very high stones can be pushed down and brought within reach. If fistula results, the consequences will not be as serious as they may be when the sacral, the rectal, or the Doyen method is employed, and the operations for fistula are easier through the vagina than through the other routes mentioned. The ureteral and vaginal walls can be sutured *en masse* with success. As the ureter is always dilated in these cases, this suturing is less difficult than it appears on first sight. If the ureter leaks subsequently, the leakage will take place between the stitches and no harm will result. Of all the advantages gained, that with reference to time is the most important.

DISCUSSION.

Dr. W. K. Otis. Important as it is that we should definitely determine the presence and location of calculi in the upper urinary tract, we have at present no means applicable to *all cases* by which this end may be attained, no method of diagnosis which is without possible fallacy, and although recent discoveries have added greatly to the facility and certainty with which we may appreciate the presence or absence of stone, none of them is infallible.

As these different methods have been considered at length, I shall merely run over the most prominent with reference to this point. Pain is probably the most prominent symptom in renal calculus, and at all events is the one which the patient considers the most important, and yet the pain, no matter how characteristic, may be caused by disease in the bladder, by certain diseases of the kidney, by disease in adjacent organs or on the other hand, the presence of calculus in the kidney may cause painful symptoms referable to the bladder alone, *or pain may be entirely absent.*

Hematuria may be entirely absent or the presence of blood may be due to some other lesion unconnected with stone, and the same is true of pyuria and the microscopical findings in the urine.

The passage of the wax coated ureteral bougie will frequently give a positive result, but there is the danger of the wax being accidentally scratched during the introduction, but more especially that the catheter will pass by the stone, even when the latter is located in the ureter itself, without giving any indication of its presence, and I have seen cases in which this has occurred, where at one sitting, it was impossible to touch the stone which was readily felt at another time, well down in the ureter, a position which it had occupied all along.

With the coming of the X-ray, surgeons had every reason to feel that at last the important problem of exact diagnosis of stone in the kidney had been solved

and this method has certainly done a great deal to aid us in making a positive diagnosis, at all events it has enabled us to shift a part of the responsibility on to the shoulders of the skiagrapher, and if after operation one fails to find a stone, he can always point triumphantly to the "shadow" on the plate.

Unfortunately the X-ray gives us the least information in just those cases where information is so important, I refer to the fat patients, to whom an operation is more important because it is much more difficult and the chances of recovery are not so favorable, and it is in these cases that the X-ray is absolutely useless. We expect definite information from the X-ray, and to see a photographer, holding up a plate at various angles and in different lights and wondering if there is a shadow on the plate or not, and if there is a shadow whether it is a stone in the ureter or not, is simply maddening to the surgeon.

Moreover when a clear and certain shadow is present, and appears in a number of plates, it yet remains an uncertainty as to whether the shadow is not due to phleboliths, or a diseased condition of the arteries or to some foreign body in the intestines, or to something else, for at any rate I have seen a number of cases in which stones were positively located by the X-ray which were absent on operation, so that neither the positive or negative findings of the X-ray can be positively relied upon.

Lastly, the kidney may be exposed in the loin and carefully needled, the pelvis opened—and the kidney split in halves without revealing the presence of stone in its substance.

Dr. AYRES. If the X-ray shows a shadow, and there seems to be some question of the shadow being cast by a calculus in the ureter, a catheter may be passed and then a stylet passed through the catheter; the picture then taken may show the shadow at some distance from the shadow of the stylet and therefore some distance from the ureter. In regard to the wax-tipped catheter in the male, I have used it on probably fifteen cases, and in only one patient have I gotten a scratch. The scratch was obtained at six inches, and I have passed the wax-tipped catheter on this patient twelve times and obtained the scratch only three times. Dr. Heitzman made the diagnosis of calculus in the ureter.

Dr. R. T. MORRIS. Are there any constant differences between the symptoms of nephrolithiasis and of appendicitis, aside from the cases in which positive testimony is offered by the character of the urine? I think so. In acute appendicitis, we have my double A, B, C, diagnosis (*i. e.*, Acuteness of Attack. Board Belly. Colic and Constipation.) In nephrolithiasis with acute manifestations, the board belly is usually absent unless a calculus is engaged in the ureter, and constipation is not such a constant feature as it is in appendicitis. The attack is not so definitely acute as it is in appendicitis. The degree of shock is greater than it is in appendicitis, for the reason that the great renal sympathetic nerves are in such close connection with the solar plexus, that more profound general disturbance follows acute irritation of the kidney than it does of irritation of the lumbar plexus from an infected appendix.

In chronic cases are there any constant differences between the symptoms of nephrolithiasis and of appendicitis? I think so. In chronic appendicitis we shall find the right lumbar plexus always distinctly tender on finger point pressure, while this feature does not belong to nephrolithiasis. Press upon this plexus an inch to the right of the navel, and one will get pretty important testimony, of negative or of positive character.

In a case of chronic appendicitis there is almost always more or less protective spasm of the muscles of the right abdominal wall when we make palpation. In

chronic nephrolithiasis, there is little if any tendency to this protective muscular spasm.

I have avoided the temptation to describe more elaborate differences between the symptoms of the two conditions under discussion, in order to concentrate attention upon the points made.

Dr. CARL BECK. I always had a predilection for renal surgery, because my first surgical teacher, Gustav Simon of Heidelberg, performed the first nephrectomy (1869), and was virtually the father of modern renal surgery. He was the one who introduced the ingenious ideas of Marion Sims in Germany. I am sorry the question of renal skiagraphy was treated in so lukewarm a manner by the very men who are justly regarded as experts in this field. If Otis speaks of two or three years ago, I agree with him, but I disagree as to the present state of skiagraphy. I am convinced that with a few exceptions, the diagnosis of nephrolithiasis can always be made by the X-ray. Oxalate of lime calculi are by far the most frequent. They lead to surgical interference more frequently than the other varieties, because they produce more suffering. Skiagraphy of to-day will show the smallest stone. I am sorry I was not prepared to bring along some of my work, but I refer as proofs of my statement to some of my recent publications on the subject. I have by the aid of the diaphragm found the stone in all of my cases. It is true we all make mistakes, but there is a difference between justifiable and unjustifiable mistakes. We must demand that every surgeon be his own skiagrapher. I have made a great many poor skiagraphs, but the difference between myself and some other colleague is that I know when I have made a poor one and I am not guided by it. I will keep on and try to obtain a better one, and I take ten if necessary. In an exact science we must not guess. We require the X-ray absolutely to know exactly, and we can rely on what it tells us, provided the skiagraph is good. We must not tax our power of imagination. If we desire to do this, we can do it without the Roentgen method.

Dr. KEYES. Dr. Heitzmann gave us some interesting remarks on the urine, but he did not touch on one point. Does stone in the kidney or ureter cause microscopic blood to appear after exercise?

Dr. HEITZMANN. When Dr. Keyes speaks of microscopic blood, he probably means red blood corpuscles found with the microscope. These corpuscles are present under the microscope in practically every inflammation to a greater or less degree and seen even in cases of hyperemia, so that their presence is of no special significance. After exercise the blood corpuscles may be temporarily increased, but not necessarily to an appreciable amount.

Dr. DEIKS. I want to say that I sympathize with Dr. Beck's remarks. The X-ray has now become a specialty, and the man who is doing skiagraphy is in a position to obtain results. If the man who uses it therapeutically, endeavors to get skiagraphs, he has a field to give special attention. There are no two tubes alike. A certain tube in a certain apparatus will give brilliant results and not in another, and vice versa. You may have to take six, eight or ten before you can get good results. In regard to the medical aspect, I have had considerable experience along these lines, but I do not want to take up your time.